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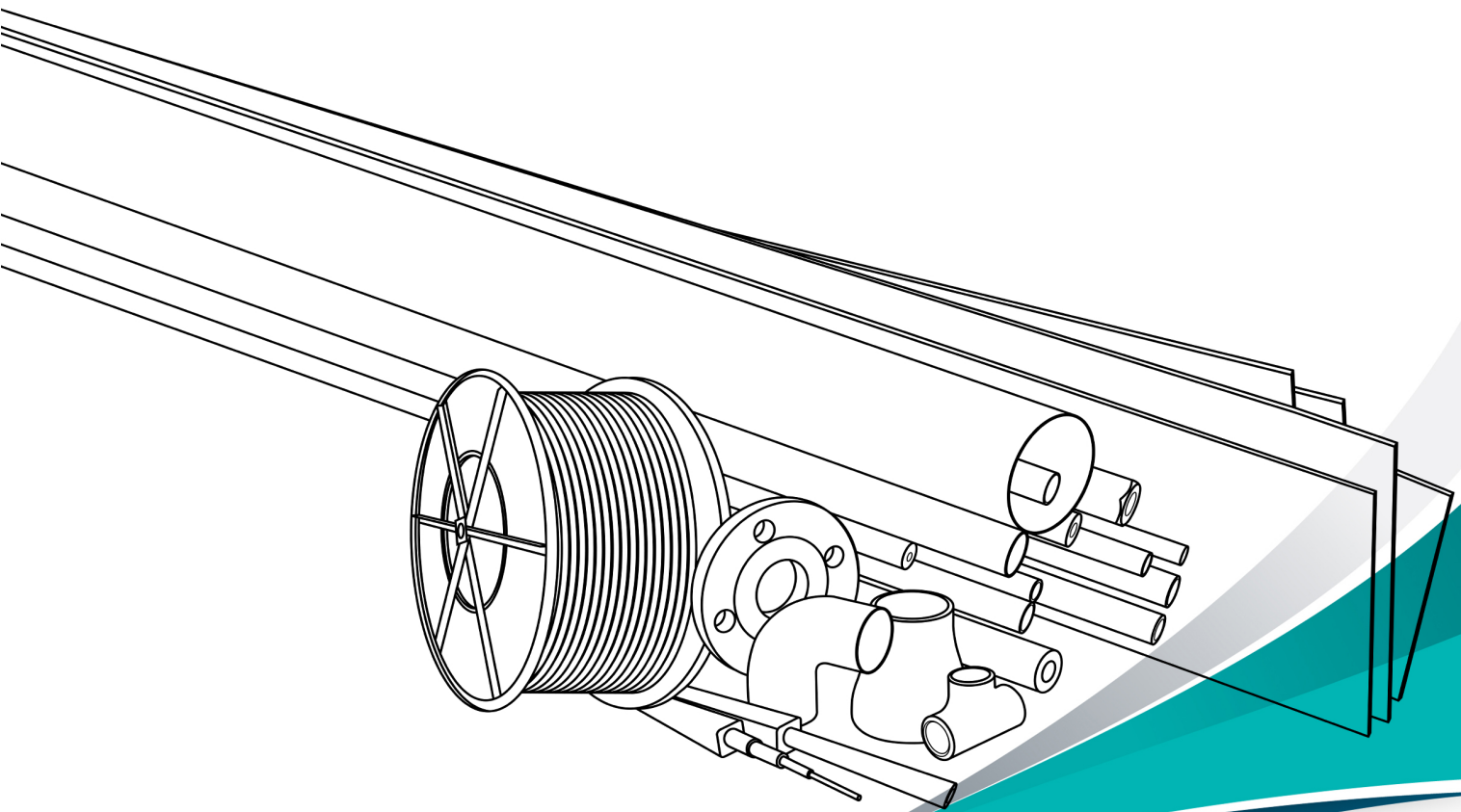

ASTM B619 Standard Specification

Designation: B619/B619M – 19

Standard Specification for Welded Nickel and Nickel-Cobalt Alloy Pipe[1]

This standard is issued under the fixed designation B619/B619M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification[2] covers welded pipe of nickel and nickel-cobalt alloys (UNS N10001; UNS N10242; UNS N10665; UNS N12160; UNS N10624; UNS N10629; UNS N10675; UNS N10276; UNS N06455; UNS N06007; UNS N06975; UNS N08320; UNS N06002; UNS N06022; UNS N06035; UNS N06044; UNS N06058; UNS N06059; UNS N06200; UNS N06235; UNS N10362; UNS N06985; UNS N06030; UNS R30556; UNS N08031; UNS N08034; UNS N06230; UNS N06686; UNS N06210; and UNS R20033)[3] as shown in Table 1.

1.2 This specification covers pipe in Schedules 5S, 10S, 40S, and 80S through 8-in. nominal pipe size and larger as set forth in ANSI B36.19 (see Table 2).

1.3 Two classes of pipe are covered as follows:

1.3.1 *Class I*—As welded and solution annealed or welded and sized and solution annealed.

1.3.2 *Class II*—Welded, cold worked, and solution annealed.

1.4 All pipe shall be furnished in the solution annealed and descaled condition. When atmosphere control is used, descaling is not necessary.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to become familiar with all hazards including those identified in the appropriate Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate safety, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

B775 Specification for General Requirements for Nickel and Nickel Alloy Welded Pipe

B899 Terminology Relating to Non-ferrous Metals and Alloys

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 *ANSI Standards:*[5]

B36.19 Stainless Steel Pipe

B2.1 Pipe Threads

2.3 *ASME Boiler and Pressure Vessel Code*[6]

Section IX Welding and Brazing Qualifications

3. Terminology

3.1 For definitions of terms used in this standard refer to Terminology B899.

4. General Requirement

4.1 Material furnished under this specification shall conform to the applicable requirements of Specification B775 unless otherwise provided herein.

[1] This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt and Their Alloys.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Specification SB-619 in Section II of that Code.

[3] New designation established in accordance with Practice E527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

[4] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[6] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.

*A Summary of Changes section appears at the end of this standard

TABLE 1 Chemical Requirements

	Composition Limits, %																						
	Ni	Cr	Mo	Fe	W	C	Si max	Co	Mn	V	P max	S max	Ti	Cu	Cb (Nb) +Ta	Al	Zr	La	N	B	Cb (Nb)	Ta	Ni+ Mo	Mg
Ni-Mo Alloys																								
N10001	remainder[A]	1.0 max	26.0-30.0	4.0-6.0	...	0.05 max	1.0	2.5 max	1.0 max	0.2-0.4	0.04	0.03	...	...	...									
N10665	remainder[A]	1.0 max	26.0-30.0	2.0 max	...	0.02 max	0.10	1.0 max	1.0 max	...	0.04	0.03	...	...	...									
N10675	65.0 min	1.0-3.0	27.0-32.0	1.0-3.0	3.0 max	0.01 max	0.10	3.0 max	3.0 max	0.20 max	0.030	0.010	0.20 max	0.20 max	...	0.50 max	0.10 max	...	...	...	0.20 max	0.20 max	94.0-98.0	
N10629	remainder[A]	0.5-1.5	26.0-30.0	1.0-6.0	...	0.01 max	0.05	2.5 max	1.5 max	...	0.04	0.01	...	0.5 max	...	0.1-0.5	...	...	...	...	...	...	...	
N10624	remainder[A]	6.0-10.0	21.0-25.0	5.0-8.0	...	0.01 max	0.10	1.0 max	1.0 max	...	0.025	0.01	...	0.5 max	...	...	...	...	...	...	...	...	...	
Ni-Mo-Cr-Fe Alloy																								
N10242	remainder[A]	7.0-9.0	24.0-26.0	2.0 max		0.03 max	0.80	1.00 max	0.80 max		0.030	0.015		0.50 max		0.50 max				0.006 max				
Low C Ni-Cr-Mo Alloys																								
N10276	remainder[A]	14.5-16.5	15.0-17.0	4.0-7.0	3.0-4.5	0.010 max	0.08	2.5 max	1.0 max	0.35 max	0.04	0.03	...	...	...									
N06022	remainder[A]	20.0-22.5	12.5-14.5	2.0-6.0	2.5-3.5	0.015 max	0.08	2.5 max	0.5 max	0.35 max	0.02	0.02	...	...	...									
N06035	remainder[A]	32.25-34.25	7.60-9.00	2.00 max	0.60 max	0.050 max	0.60	1.00 max	0.50 max	0.20 max	0.030	0.015	...	0.30 max	...	0.40 max								
N06044	balance	43.5-45.3	0.80-1.20	0.3 max	...	0.02 max	0.20	...	0.07-0.30	...	0.020	0.020	0.10-0.30	...	...	0.30 max	...	...	...	...	...	...	...	...
N06058	balance	20.0-23.0	18.5-21.0	1.5 max	0.3 max	0.010 max	0.10 max	0.3 max	0.50 max		0.015	0.010	...	0.50 max	...	0.40 max			0.02-0.15					
N06059	balance	22.0-24.0	15.0-16.5	1.5 max	...	0.010 max	0.10	0.3 max	0.5 max	...	0.015	0.010	...	0.50 max	...	0.1-0.4	...	...	...	...	...	...	...	
N06455	remainder[A]	14.0-18.0	14.0-17.0	3.0 max	...	0.015 max	0.08	2.0 max	1.0 max	...	0.04	0.03	0.70 max	...	...									
Ni-Cr-Fe-Mo-Cu Alloys																								
N06007	remainder[A]	21.0-23.5	5.5-7.5	18.0-21.0	1.0 max	0.05 max	1.0	2.5 max	1.0-2.0	...	0.04	0.03	...	1.5-2.5	1.75-2.5									
N06975	47.0-52.0	23.0-26.0	5.0-7.0	remainder	...	0.03 max	1.0	...	1.0 max	...	0.03	0.03	0.70-1.50	0.70-1.20	...									
N06985	remainder[A]	21.0-23.5	6.0-8.0	18.0-21.0	1.5 max	0.015 max	1.0 max	5.0 max	1.0 max	...	0.04	0.03	...	1.5-2.5	0.50 max									
N06030	remainder[A]	28.0-31.5	4.0-6.0	13.0-17.0	1.5-4.0	0.03 max	0.8	5.0 max	1.5 max	...	0.04	0.02	...	1.0-2.4	0.30-1.50									
Ni-Fe-Cr-Mo Alloys																								
N08320	25.0-27.0	21.0-23.0	4.0-6.0	remainder	...	0.05 max	1.0	...	2.5 max	...	0.04	0.03	4xC min	...	...									
Ni-Cr-Mo-Fe Alloy																								
N06002	remainder[A]	20.5-23.0	8.0-10.0	17.0-20.0	0.20-1.0	0.05-0.15	1.0	0.5-2.5	1.0 max	...	0.04	0.03	...	...	...									
Ni-Fe-Cr-Co Alloy																								
R30556	19.0-22.5	21.0-23.0	2.5-4.0	remainder	2.0-3.5	0.05-0.15	0.20-0.80	16.0-21.0	0.50-2.00	...	0.04	0.015	...	...	...	0.10-0.50	0.001-0.10	0.005-0.10	0.10-0.30	0.02 max	0.30 max	0.3-1.25		

TABLE 1 *Continued*

	Composition Limits, %																						
	Ni	Cr	Mo	Fe	W	C	Si max	Co	Mn	V	P max	S max	Ti	Cu	Cb (Nb) +Ta	Al	Zr	La	N	B	Cb (Nb)	Ta	Ni+ Mo	Mg
Ni-Cr-W-Mo Alloy N06230	remainder[A]	20.0-24.0	1.0-3.0	3.0 max	13.0-15.0	0.05-0.15	0.25-0.75	5.0 max	0.30-1.00	...	0.03	0.015	...	...	...	0.50 max	...	0.005-0.050	...	0.015 max	...	...		
Low C-Ni-Cr-Mo-Cu Alloy N06200	remainder[A]	22.0-24.0	15.0-17.0	3.0 max	...	0.010 max	0.08	2.0 max	0.50 max	...	0.025	0.010	...	1.3-1.9	...	0.50 max								
Low-C-Ni-Mo-Cr Alloy N10362	remainder[A]	13.8-15.6	21.5-23.0	1.25 max	...	0.010 max	0.08	...	0.60 max	...	0.025	0.010	...	...	...	0.50 max	...	...	...	...	...	...	...	...
Low C-Ni-Fe-Cr-Mo-Cu Alloy N08031	30.0-32.0	26.0-28.0	6.0-7.0	balance	...	0.015 max	0.3	...	2.0 max	...	0.020	0.010	...	1.0-1.4	...	...	...	...	0.15-0.25	...	...	...		
N08034	33.5-35.0	26.0-27.0	6.0-7.0	balance	...	0.01 max	0.1	...	1.0-4.0	...	0.020	0.010	...	0.5-1.5	...	0.3 max	...	...	0.10-0.25	...	...	...	...	...
Low C-Ni-Cr-Mo-W Alloy N06686	remainder[A]	19.0-23.0	15.0-17.0	5.0 max	3.0-4.4	0.010 max	0.08	...	0.75 max	...	0.04	0.02	0.02-0.25	...	...	...	...	...	...	...	...	...		
Ni-Co-Cr-Si Alloy N12160	remainder[A]	26.0-30.0	1.0 max	3.5 max	1.0 max	0.15 max	2.4-3.0	27.0-33.0	1.5 max	...	0.030	0.015	0.20-0.80	...	...	...	...	...	...	...	1.0 max	...	...	...
Cr-Ni-Fe-N Alloy R20033	30.0-33.0	31.0-35.0	0.50-2.0	balance	...	0.015 max	0.50	...	2.0 max	...	0.02	0.01	...	0.3-1.20	...	...	...	...	0.35-0.60	...	...	...	...	...
Low C-Ni-Mo-Cr-Ta Alloy N06210	remainder[A]	18.0-20.0	18.0-20.0	1.0 max	...	0.015 max	0.08	1.0 max	0.5	0.35 max	0.02	0.02	...		...		...	...	...	...	...	1.5-2.2		
N06235	remainder[A]	30.0-32.5	5.0-6.2	1.5 max	0.60 max	0.02-0.06	0.2-0.6	1.0 max	0.3-0.65	...	0.03	0.015	0.5 max	3.5-4.0	...	0.2-0.4	...	...	...	...	1.0 max	...	...	...

[A] The composition of the remainder shall be determined arithmetically by difference.

TABLE 2 Dimensions of Welded Pipe

NOTE 1—The following table is a partial reprint of Table 1 of ANSI B36.19.

NOTE 2—The decimal thickness listed for the respective pipe sizes represents their nominal or average wall dimensions.

Nominal Pipe Size,	Outside Diameter		Nominal Wall Thickness							
			Schedule 5S[A]		Schedule 10S[A]		Schedule 40S		Schedule 80S	
in.	in.	[mm]	in.	[mm]	in.	[mm]	in.	[mm]	in.	[mm]
⅛	0.405	10.29	...	...	0.049	1.24	0.068	1.73		
¼	0.540	13.72	...	...	0.065	1.65	0.088	2.24		
⅜	0.675	17.15	...	...	0.065	1.65	0.091	2.31		
½	0.840	21.34	0.065	1.65	0.083	2.11	0.109	2.77		
¾	1.050	26.67	0.065	1.65	0.083	2.11	0.113	2.87		
1.0	1.315	33.41	0.065	1.65	0.109	2.77	0.133	3.38		
1¼	1.660	42.16	0.065	1.65	0.109	2.77	0.140	3.56		
1½	1.900	48.26	0.065	1.65	0.109	2.77	0.145	3.68		
2	2.375	60.33	0.065	1.65	0.109	2.77	0.154	3.91	0.218	5.54
2½	2.875	73.03	0.083	2.11	0.120	3.05	0.203	5.16	0.276	7.01
3	3.500	88.90	0.083	2.11	0.120	3.05	0.216	5.33		
3½	4.000	101.60	0.083	2.11	0.120	3.05	0.226	5.74		
4	4.500	114.30	0.083	2.11	0.120	3.05	0.237	6.02		
5	5.563	141.30	0.109	2.77	0.134	3.40	0.258	6.55		
6	6.625	168.28	0.109	2.77	0.134	3.40	0.280	7.11		
8	8.625	219.18	0.109	2.77	0.148	3.76	0.322	8.18		

[A] Schedules 5S and 10S wall thicknesses do not permit threading in accordance with ANSI B2.1-1960.

5. Ordering Information

5.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Examples of such requirements include, but are not limited to the following:

5.1.1 *Alloy* (Table 1),

5.1.2 *Class* (see 1.3),

5.1.3 *Quantity* (feet or number of lengths),

5.1.4 *Size* (nominal size or outside diameter and schedule number or average wall thickness),

5.1.5 *Length*—Specify cut length or random,

5.1.6 *Certification*—State if certification or a report of test results is required,

5.1.7 *Purchaser Inspection*—State which tests or inspections are to be witnessed,

5.1.8 *Ends*—Plain ends cut and deburred will be furnished, unless otherwise specified, and

5.1.9 *Samples for Product (Check) Analysis*—State whether samples shall be furnished.

6. Materials and Manufacture

6.1 The pipe shall be made from flat-rolled alloy by an automatic welding process with no addition of filler metal.

6.2 Subsequent to welding and prior to final heat treatment, Class II pipes shall be cold worked either in both weld and base metal or in weld metal only. The method of cold working may be specified by the purchaser.

7. Chemical Composition

7.1 The material shall conform to the composition limits specified in Table 1.

7.2 If a product (check) analysis is made by the purchaser, the material shall conform to the requirements specified in Table 1 subject to the permissible tolerances in Specification B775.

8. Mechanical Properties and Other Requirements

8.1 *Tension Test*—The tensile properties of the material at room temperature shall conform to those shown in Table 3.

8.1.1 One tension test shall be made on each lot of pipe.

8.2 *Flattening Test*—One flattening test shall be made on a specimen from one end of one pipe from each lot.

8.3 *Transverse Guided Bend Test:*

8.3.1 At the option of the pipe manufacturer, the transverse guided bend test may be substituted in lieu of the flattening test. Two bend specimens shall be taken transversely from pipe or the test specimens may be taken from a test plate of the same material and heat as pipe, which is attached to the end of the cylinder and welded as a prolongation of the pipe longitudinal seam. Except as provided in 8.3.2, one shall be subjected to a face guided bend and a second to a root guided bend test. One specimen shall be bent with the inside surface of the pipe against the plunger and the other with the outside surface of the pipe against the plunger. Guided bend test specimens shall be prepared and tested in accordance with Section IX, Part QW 160 of the ASME Boiler and Pressure Vessel Code and shall be one of the types shown in QW462.2 and QW462.3 of that code.

8.3.2 For specified wall thicknesses ⅜ in. [9.5 mm] and over, but less than ¾ in. [19 mm] side bend tests may be made instead of the face and root bend tests. For specified wall thicknesses ¾ in. [19 mm] and over, both specimens shall be subjected to the side bend tests. Side bend specimens shall be bent so that one of the side surfaces becomes the convex surface of the bend specimen.

8.3.3 The bend test shall be acceptable if no cracks or other defects exceeding ⅛ in. [3 mm] in any direction be present in the weld metal or between the weld and the pipe or plate metal after bending. Cracks which originate along the edges of the specimen during testing, and are less than ¼ in. [6.5 mm] measured in any direction shall not be considered.

TABLE 3 Mechanical Properties of Pipe

Alloy	Tensile Strength, min, ksi [MPa]	Yield Strength (0.2 % Offset), min, ksi [MPa]	Elongation in 2 in. [50.8 mm] or 4*D*,[A] min, %
Ni-Mo Alloys			
alloy N10001	100 [690]	45 [310]	40
alloy N10665	110 [760]	51 [350]	40
alloy N10675	110 [760]	51 [350]	40
alloy N10629	110 [760]	51 [350]	40
alloy N10624	104 [720]	46 [320]	40
Ni-Mo-Cr-Fe Alloy			
alloy N10242	105 [725]	45 [310]	40
Low C Ni-Cr-Mo Alloys			
alloy N10276	100 [690]	41 [283]	40
alloy N06022	100 [690]	45 [310]	45
alloy N06035	85 [586]	35 [241]	30
alloy N06044	90 [620]	45 [310]	20
alloy N06455	100 [690]	40 [276]	40
alloy N06235	90 [620]	35 [240]	35
Ni-Cr-Fe-Mo-Cu Alloys			
alloy N06007	90 [621]	35 [241]	35
alloy N06975	85 [586]	32 [221]	40
alloy N06985	90 [621]	35 [241]	45
alloy N06030	85 [586]	35 [241]	30
Ni-Fe-Cr-Mo Alloy (N08320)	75 [517]	28 [193]	35
Ni-Cr-Mo-Fe Alloy (N06002)	100 [690]	40 [276]	35
Ni-Fe-Cr-Co Alloy (R30556)	100 [690]	45 [310]	40
Ni-Cr-W-Mo Alloy (N06230)[B]	110 [760]	45 [310]	40
Low C-Ni-Cr-Mo Alloys			
alloy N06058	110 [760]	52 [360]	40
alloy N06059	100 [690]	45 [310]	45
Low C-Ni-Cr-Mo-Cu Alloy (N06200)	100 [690]	45 [310]	45
Low C-Ni-Mo-Cr Alloy (N10362)	105 [725]	45 [310]	40
Ni-Fe-Cr-Mo-Cu Low Carbon Alloy (N08031)	94 [650]	40 [276]	40
Alloy (N08034)	94 [650]	40 [280]	40
Low C Ni-Cr-Mo-W Alloy (N06686)	100 [690]	45 [310]	45
Ni-Co-Cr-Si alloy (N12160)	90 [620]	35 [240]	40
Cr-Ni-Fe-N Low Carbon Alloy (R20033)	109 [750]	55 [380]	40
Low C Ni-Cr-Mo-Ta Alloy (N06210)	100 [690]	45 [310]	45

[A] *D* refers to the diameter of the tension specimen.
[B] Solution annealed at a temperature between 2200 to 2275°F [1204 to 1246°C] followed by a water quench or rapidly cooled by other means.

TABLE 4 Permissible Variations in Outside Diameter

Nominal Pipe Size, in.	Permissible Variation in Outside Diameter[A]			
	in.		mm	
⅛ [10.29]	+0.002	−0.006	+0.05	−0.15
¼ [13.72]	+0.003	−0.008	+0.08	−0.20
⅜ [17.15]	+0.004	−0.008	+0.08	−0.20
½ [21.34]	+0.004	−0.010	+0.10	−0.25
¾ [26.67]	+0.005	−0.012	+0.13	−0.30
1 [33.41]	+0.005	−0.012	+0.13	−0.30
1¼ [42.16]	+0.005	−0.012	+0.13	−0.30
1½ [48.26]	+0.008	−0.015	+0.20	−0.38
2 [60.22]	+0.010	−0.016	+0.25	−0.41
2½ [73.03]	+0.010	−0.016	+0.25	−0.41
3 [88.90]	+0.012	−0.018	+0.30	−0.46
3½ [101.60]	+0.012	−0.018	+0.30	−0.46
4 [114.30]	+0.014	−0.020	+0.36	−0.51
5 [141.30]	+0.063	0.031	+1.60	−0.79
6 [168.28]	+0.063	0.031	+1.60	−0.79
8 [219.18]	+0.063	0.031	+1.60	−0.79

[A] The permissible variations in the above table apply to individual measurements, including out of roundness (ovality).

8.4 *Hydrostatic or Nondestructive Electric Test*—Each pipe shall be subjected to either the hydrostatic or the nondestructive electric test at the manufacturer's option.

9. Dimensions and Permissible Variations

9.1 *Wall Thickness*—Variations in wall thickness shall not exceed the specified nominal wall thickness by more than ±12½ %, except as follows:

9.1.1 If weld beads are present on the inner surface of the pipe, they shall not exceed the wall thickness of the pipe by more than 20 % or 0.050 in. [1.27 mm], whichever is less, of the specified nominal wall thickness for Class I pipe, and 5 % or 0.005 in. [0.127 mm], whichever is less, of the specified nominal wall thickness for Class II pipe.

9.1.2 Sunken welds in Class I pipe shall not be deeper than 15 % of the specified nominal wall thickness and never deeper than 0.030 in. [0.79 mm]. Class II pipe shall not have sunken welds.

9.2 *Outside Diameter*—The permissible variations in outside diameter shall not exceed the limits prescribed in Table 4, except as provided for in 9.1.2.

9.3 For pipe diameters greater than shown in Table 4, permissible variations in dimensions at any point in a length of pipe shall not exceed the following:

9.3.1 *Outside Diameter*—Based on circumferential measurement, ±0.5 % of the nominal outside diameter.

9.3.2 *Out-of-Roundness*—Differences between major and minor outside diameters, 1.0 % of the specified outside diameter.

9.3.2.1 For thin-wall pipe, defined as pipe having a wall thickness of 3 % or less of the outside diameter, the difference in the extreme outside readings (ovality) in any one cross section shall not exceed 1.5 % of the specified outside diameter.

9.3.3 *Alignment (Camber)*—Using a 10 ft [3 m] straightedge placed so that both ends are in contact with the pipe, the camber shall not be more than ⅛ in. [3.17 mm].

10. Keywords

10.1 UNS N06002; UNS N06007; UNS N06022; UNS N06030; UNS N06035; UNS N06044; UNS N06058; UNS N06059; UNS N06200; UNS N06235; UNS N10362; UNS N06210; UNS N06230; UNS N06455; UNS N06975; UNS N06985; UNS N08031; UNS N08034; UNS N08320; UNS N10001; UNS N10242; UNS N10276; UNS N10624; UNS N10629; UNS N10665; UNS N10675; UNS R30556; UNS R20033; welded pipe

APPENDIX

(Nonmandatory Information)

X1. HEAT TREATMENT

X1.1 Proper heat treatment during or subsequent to fabrication is necessary for optimum performance, and the manufacturer shall be consulted for details.

SUMMARY OF CHANGES

Committee B02 has identified the location of selected changes to this standard since the last issue (B619/B619M–17b) that may impact the use of this standard. (Approved November 1, 2019.)

(1) Added new alloy UNS N06235 to Section 1.
(2) Added chemistry data for UNS N06235 to Table 1.
(3) Added Mechanical property data to Table 3 for UNS N06235.
(4) Added UNS N06235 in Keywords in Section 10.